Voltammetric variations with structure of latex particles

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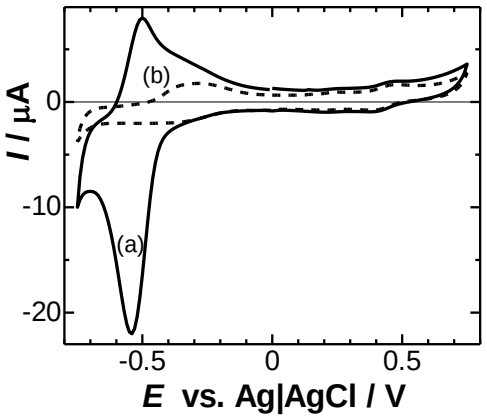
Latex particles have been used for fabrication of uniform films. on modified electrodes which applied to bioengineering and biotechnology. Particle structure often alters the electrochemical properties of modified electrodes, such as geometrical blocking of redox sites, sluggish charge propagation within a particle, and complicated transport of a particle by aggregation or adsorption.

In earlier studies we have worked on internal structure of latex which participates in mass transport by voltammetric analysis of diffusion currents of dispersed latex, such as of incorporated ferrocenyl derivatives [1,2]. The reacting domains within the particle are restricted to the surface of the particle [3] or extended to the whole particle [2], depending on the particle structure [4-6]. Such as suspended polyaniline-coated latex, it has been reduced exhaustively because it is conductive enough for maintaining the reduction potential over the whole particle through the conducting zone [7,8].

Here studies were extended to those swollen latex particles and the latex-film. Uniformly sized poly(*N*-isopropylacrylamide-*co*-acrylic acid) hydrogel particles were synthesized. The particle exhibited the densities, 0.30 g cm^{-3} and 0.98 g cm^{-3} for the dry and the wet states, respectively. They were spheres with a common diameter, which ranged from 0.5 μm to 1.0 μm depending on the pH, ionic concentration and temperature. They were swollen at low salt concentrations, low temperatures and high pH of aqueous suspensions. One particle contained 6.0×10^8 carboxyl groups, the concentration of which was ca. 1 M, exhibiting pK_a = 5.2. The particles were adsorbed spontaneously on the platinum surface in a mono-particle layer with regular arrangement. Voltammograms at the particle-coated electrode showed cathodic current of H^+, which was dissociated from the carboxylic group (Fig. Voltammograms of (a) the latex-coated and (b) the bare electrodes at 0.08 mM HCl + 0.14 mM FcTMA + 0.15 M KCl). The film did not blocking the mass transport even at shrunk particles for low pH due to the high porosity. The amount of the dissociated hydrogen ions per particle was 19% of the loaded amount of carboxyl groups, whereas the non-gelized particles had 3% of the loaded amount. It provided acidic environment of pH 4.5 for the reduction in the neutral solution.



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